

US009429759B2

(12) United States Patent

Hoellwarth

(54) HEAD-MOUNTED DISPLAY APPARATUS FOR RETAINING A PORTABLE ELECTRONIC DEVICE WITH DISPLAY

(71) Applicant: Apple Inc., Cupertino, CA (US)

(72) Inventor: Quin C. Hoellwarth, Kuna, ID (US)

(73) Assignee: **Apple Inc.**, Cupertino, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35

U.S.C. 154(b) by 0 days.

This patent is subject to a terminal dis-

claimer.

(21) Appl. No.: 14/862,036

(22) Filed: Sep. 22, 2015

(65) **Prior Publication Data**

US 2016/0085076 A1 Mar. 24, 2016

Related U.S. Application Data

- (60) Division of application No. 14/604,059, filed on Jan. 23, 2015, which is a continuation of application No. 12/242,911, filed on Sep. 30, 2008, now Pat. No. 8,957,835.
- (51) **Int. Cl. G09G 5/00** (2006.01) **G02B 27/01** (2006.01)
 (Continued)
- (52) U.S. Cl.

CPC G02B 27/0176 (2013.01); G02B 27/0093 (2013.01); G02B 27/017 (2013.01); G02B 27/0172 (2013.01); G06F 3/012 (2013.01); G06F 3/041 (2013.01); G06F 3/0412 (2013.01); H04M 1/0266 (2013.01); H04M 1/05 (2013.01);

(Continued)

(45) **Date of Patent:**

(10) **Patent No.:**

US 9,429,759 B2

*Aug. 30, 2016

See application file for complete search history.

(56) References Cited

U.S. PATENT DOCUMENTS

5,003,300 A 5,632,742 A 3/1991 Wells 5/1997 Frey et al. (Continued)

FOREIGN PATENT DOCUMENTS

DE 10047237 A1 7/2002 DE 10103922 A1 7/2002

(Continued)

Primary Examiner — Stephen Sherman (74) Attorney, Agent, or Firm — Joseph F. Guihan

(57) ABSTRACT

Head-mounted display systems and methods of operation that allow users to couple and decouple a portable electronic device such as a handheld portable electronic device with a separate head-mounted device (e.g., temporarily integrates the separate devices into a single unit) are disclosed. The portable electronic may be physically coupled to the head-mounted device such that the portable electronic device can be worn on the user's head. The portable electronic device may be operatively coupled to the head-mounted device such that the portable electronic device and head mounted device can communicate and operate with one another. Each device may be allowed to extend its features and/or services to the other device for the purpose of enhancing, increasing and/or eliminating redundant functions between the head-mounted device and the portable electronic device.

13 Claims, 25 Drawing Sheets

